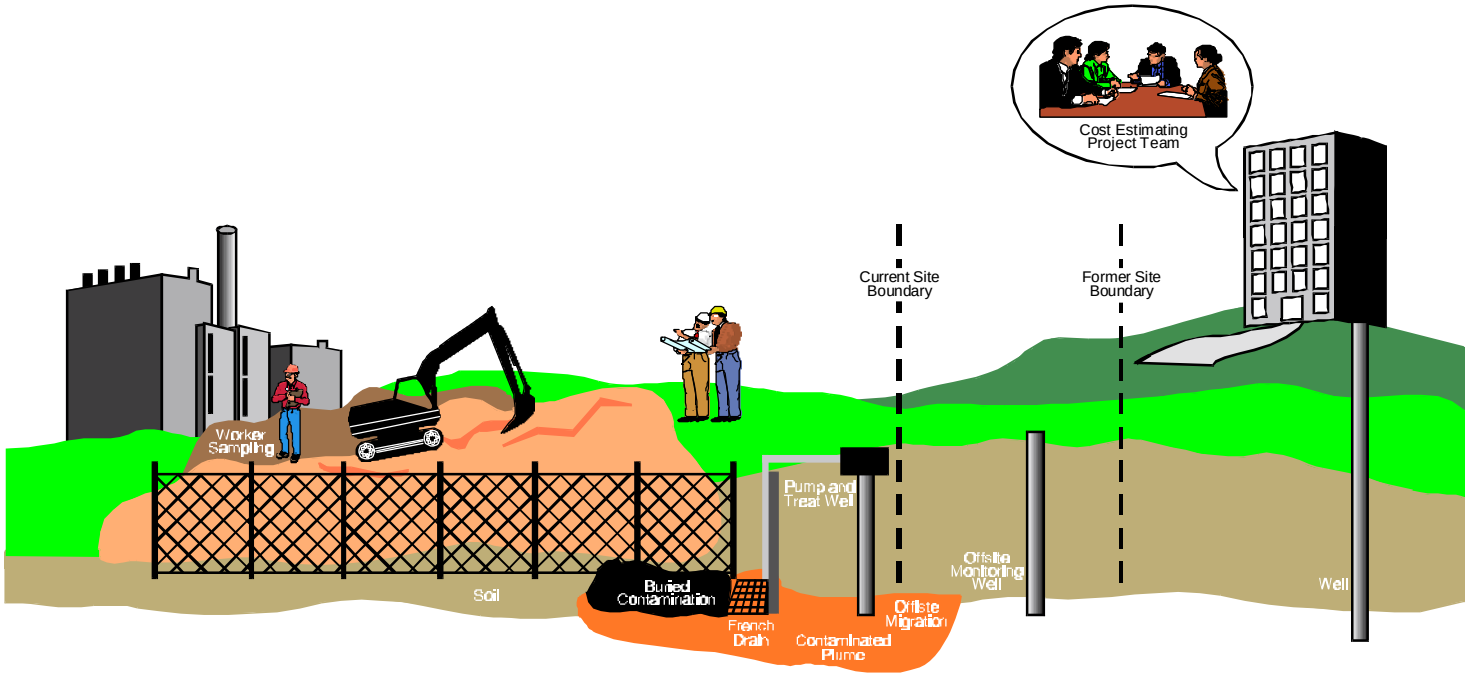
Practical Cost-Estimating and Validation Lessons-Learned Workshop

September 1997



Sponsored by DOE's ER Applied Cost Engineering (ACE) Team, a Joint Field-Headquarters Working Group

DOE F 1325.8
(8-89)
EFG (07-90)

United States Government **Department of Energy**

memorandum

DATE:

REPLY TO ATTN OF: EM-45 (A. Rampertaap, EM-45, 301-903-8191)

SUBJECT: Practical Cost-Estimating and Validation Lessons-Learned Workshop Notebook

TO:

Distribution

The Applied Cost Engineering (ACE) Team, Cost Lessons-Learned Workshop Subteam has given me a copy of the Practical Cost-Estimating and Validation Lessons-Learned Workshop Notebook. (The ACE Team is a joint Field/Headquarters working group established to promote better fiscal management and control of Environmental Restoration programs.) Autar Rampertaap, the Cost-Estimating and Validation Lessons-Learned Workshop Subteam Leader, has told me of the considerable Field/Headquarters cooperation on this effort. I am impressed by the outstanding job done by the ACE Team on this notebook. The topics covered (cost-estimating concepts, preparing a planning estimate, preparing a detailed estimate, and validating a cost estimate) can make an immediate, positive impact in the quality of our cost estimates. The unique structure of the notebook will enable each member of the ACE Team to successfully conduct a workshop session using the notebook. This was a very "pro-active" effort which should ultimately lead to greater cost savings on Environmental Restoration projects.

Thank you for providing a workshop notebook which will enable program managers, project managers, scientists, and engineers to better manage and control remediation and decommissioning projects. The workshop should improve our cost estimating and validation practices and sharing of lessons learned. I would also like to thank James Owendoff and William Wisenbaker for supporting the activities of the ACE Team. The ACE Team's development of this notebook is a paradigm for constructive Headquarters/Field interaction. I look forward to seeing the results of the work you have planned for fiscal year 1998; in particular, the initiatives to develop performance measurement and budget-year baseline validation workshop modules.

Attached is a "hard copy" of the notebook. Each Field location

will also receive a CD-ROM containing the full text of the notebook. This notebook is approved for use upon distribution. Each Field Office is free to use the notebook contents and adapt the materials to meet site-specific needs. Additionally, the ACE Team will present workshops at Field sites expressing a desire to host the workshop. The first workshop will be hosted by the Ohio Field Office.

Let me once again thank all the ACE Team members for developing a workshop notebook which will improve understanding of cost estimating and validating crosscutting practices through the sharing of lessons learned. Keep up the good work!

If you have any questions, please contact Bryan Skokan at 301-903-7612 or Autar Rampertaap at 301-903-8191.

/s/ 10/7/97 by
William E. Wisenbaker
for

James J. Fiore
Acting Deputy Assistant Secretary
for Environmental Restoration

Attachment:
Practical Cost Estimating and Validation Lessons-Learned Workshop Notebook

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/ /97

EM-40
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/ /97

EM-45 Correspondence Reviewer: _____

EM-40 Correspondence Reviewer: _____

Distribution
Subject: ____
EM-40 (2)
EM-40/Wisenbaker
EM-45/Originator
EM-45/Rdr

EM-45:ARampertaap:smg:903-3850:09/24/97:[Q:\EM-45\WP\LLWKTRA2.WPD]
Rewritten:EM-45:VFayne:smg:09/30/97
Rewritten:EM-45:Rampertaap:caw:10/01/97
Revised:EM-45:sd:10/3/97
M/R:
Returned signed memo to originator for distribution.

TABLE OF CONTENTS

Discussion Leader/Facilitator and Note Taker Guidance

The information below is provided to give the workshop discussion leader/facilitator and note taker information on how the workshop material is structured and provide suggestions on workshop preparation. The workshop material was developed by the ACE Team with the intent of providing a comprehensive package that could be used by all field and headquarters offices and led by non-subject matter experts.

Workshop Players:

Discussion Leader(s)/Facilitator(s) is/are the individual(s) that will be responsible for leading and/or presenting the workshop topics. This individual should be an U.S. Department of Energy (DOE) federal employee. The material is structured to provide these individuals with all of the necessary subject matter to lead the participants through the workshop material. Notes provide additional information with which to explain the overhead slide material and/or provide calculations to work through example problems. Discussion Leader/Facilitator Notes are provided under the overhead slides where needed to give special instructions, direction, guidance, or reminders.

A *Note Taker* should be assigned for each workshop. A note taker can be a workshop participant. This individual can be either a DOE federal employee or a subcontractor. The note taker is responsible for recording lessons learned that are shared during the workshop and are significant enough to record and document. These lessons learned are recorded by the note taker throughout the workshop on a easel so that the participants can confirm the wording used to record the lesson. After the workshop, the note taker is responsible for submitting the lessons learned to the ACE Team for incorporation in the ACE Team lessons learned home page.

Participants are the workshop attendees. Participants are responsible for sharing personal experiences that can provide lessons learned for others.

Number of Workshop Players

The workshop material is structured so that one discussion leader/facilitator and one note taker can conduct this workshop. However, it is recommended that a minimum of three discussion leaders/facilitators and one note taker be used to manage the workshop (more players can be used if the workshop is presented by subsections).

Workshop Equipment:


Two white boards or paper flip chart easels


Two overhead projectors

Notebook Material

The notebook is laid out by section and subsection as shown in the Table of Contents. Each subsection of the notebook is separated by a tab. Each notebook page is laid out as follows:

(Continued on next page)

Section #: Title of the Section

Overhead Slide Subject

Discussion Leader/Facilitator Notes:

Notes

Notes / Discussion Points / Lessons Learned:

The Overhead Slide is provided for use on the overhead projector. This slide will provide the discussion leader/facilitator with the key concepts to be discussed.

The Discussion Leader/Facilitator Notes provide special instructions, direction, guidance, or reminders to the discussion leader/facilitator.

The Notes provide the discussion leader/facilitator additional information by which to explain the overhead slide material and/or provide calculations to work through example problems. Within the Notes, the following icons are used:

Example:
This icon is used to highlight an example provided to emphasize or explain the given topic.

Calculation:
This icon is used to highlight a calculation or formula.

Caution:
This icon is used to highlight a caution or a "don't do" relevant to the given topic.

Notes/Discussion Points/Lessons Learned is a space provided on the bottom of each page for the participants to record personal notes.

(Continued on next page)

DOE Real-Life Example Projects

The workshop material uses two real-life DOE example projects to serve as case studies for demonstrating and working through the cost estimating and validation techniques. The first example project is presented in Section 2.1 and is used in both Sections 2.1 and 2.2. The second example project is used in Section 3.3 to demonstrate the validation of a cost estimate.

Prior to the workshop the facilitator should:

- Review the entire workshop notebook, specifically focusing on section(s) that you will be presenting. The "Discussion Leader/Facilitator Notes" should be reviewed before conducting the workshop. After reviewing notebook, determine the best way to present material for the targeted audience.

- Select specific lessons-learned issues targeted to the specific audience. There are numerous examples of lessons-learned questions available to facilitate discussion. Selecting a few relevant ones will help focus the limited time available. Additional lessons learned are provided for the facilitator, if needed, in Appendix H.

- For Sections 2 and 3, determine the best approach for presenting or providing the DOE real-life example project scope and data materials. Depending on the audience, the facilitator may choose to present the example project scope information in any one of the following ways:
  - Allow participants time to read the material in workshop; or
  - Go through the information, with the participants highlighting and pointing out main points; or
  - Use some other method.

- Customize material as necessary to meet the site-specific conditions and methods. For example, if contingency is calculated prior to escalation at a specific site, presentation of escalation and contingency may be swapped in the flowchart process, or it could be pointed out that sometimes contingency is calculated prior to escalation.

Example:
Examples should be reviewed and may be replaced with site-specific examples.

Calculation:
Determine how the example calculations will be presented (e.g., facilitator to use notes to work through calculations on the flip chart).

Cautions:
- Don't allow class participants to be overly concerned with terminology (i.e., WBS, COA, cost structure).
- Make sure that the workshop focus remains on cost elements with the understanding that cost is one piece of a project plan/baseline.
- Keep the workshop focused on cost estimating; set the ground rules to assume that the scope is defined; and prevent long discussions on rescoping the example problems.

(Continued on next page)

Workshop Setup:

- The recommended seating arrangement is to use circular tables that allow participants to work and interact in small groups.

- Two overhead projectors may be used in several sections of the workshop. This will allow the flowchart overhead slide to remain in view while presenting the detail of each step in the flowchart. The "Discussion Leader/Facilitator Notes" will recommend when to use the second projector.

- A white board or paper flip chart easel may be used to present the demonstrated calculations. A second paper flip chart easel should be available for the note taker to record the generation of lessons learned that are shared. This procedure will allow everyone to review and agree on how the lessons are worded.

INTRODUCTION

Continuous improvement to systems and processes is a constant goal of the U.S. Department of Energy Office of Environmental Management (DOE-EM). Even though EM has been around for 8 years, it is still a relatively new organization and has numerous places for improvement. In DOE, these continuous improvements are derived from lessons learned; however, lessons learned are only a portion of the overall effort. Once a lesson is learned, it must be used constructively to improve the system/process with which it was associated. It also should be communicated effectively to others who may need to make similar improvements.

WORKSHOP OBJECTIVE

The workshop objective is to enable Field and Headquarters program managers, project managers, scientists, and engineers to manage and control remediation/decommissioning projects better through improved understanding of cost-estimating, validation, cross-cutting practices, and sharing of lessons learned.

WHY YOU SHOULD ATTEND

Accurate and defensible cost estimates are the key to successful management of ER projects. As a participant in DOE ER projects, you are responsible for ensuring the development and validation of project baselines. Congressional hearings, General Accounting Office (GAO) reports, Inspector General reports, Office of Management and Budget (OMB) reports, and letters from external stakeholders and both houses of Congress have directed/advised DOE to improve control of costs.

WHAT YOU WILL ACCOMPLISH

Key concepts and practical examples will be reviewed and lessons learned from DOE cleanup projects will be discussed regarding cost-estimating methods, techniques, tools, and resources; preparing a cost estimate; and reviewing and validating cost estimates.

WORKSHOP DISCUSSION LEADERS/FACILITATORS

This workshop is sponsored by the DOE Applied Cost Estimating (ACE) Team, a joint Field-Headquarters working group established to promote better fiscal management and control of ER projects/programs. ACE Team members will discuss and demonstrate cost-estimating principles, assist participants in practicing cost-estimating fundamentals, and facilitate the sharing of experience and lessons learned from actual DOE environmental cleanup and decommissioning projects. Lessons learned in many areas will be discussed.

YOU WILL GET INVOLVED!

ER examples, overhead projections, reference material, audience participation, and exercises will drive home important principles. You will also take home a comprehensive notebook packed with information to jog your memory and support your cost-estimating efforts. The ACE Team will document lessons learned and innovative ideas identified in the workshop. The ACE team and management will evaluate ideas for complex-wide applicability. Ideas with broad applicability will be disseminated across the complex.

(Continued on next page)

VALUE TO FEDERAL STAFF

This workshop is a unique opportunity to increase your knowledge of sound cost-estimating principles and practices by using actual DOE examples. The development of a joint Field-Headquarters team to enable federal managers, project managers, scientists, and engineers to understand and manage cost baselines better and to increase overall managerial and fiscal control of ER programs and projects is unprecedented. If you haven't mastered the cost-estimating process, you can't ask the right questions to ensure that cleanup is better, faster, and cheaper than current practice.

IMPORTANCE TO SCIENTISTS, ENGINEERS, AND PROGRAM AND PROJECT MANAGERS

Although the focus of the workshop is on cost estimating, remember that cost estimating and validation are an integral part of both program- and project-level functions.

AGENDA AT A GLANCE

	DAY 1	DAY 2	DAY 3	DAY 4
7:30	Registration			
8:00	Opening Remarks/ Welcome	2 Cost Estimate Preparation	2.2 Preparation of a Detailed Cost Estimate (Continued)	3.3 Cost-Estimate Validation Example
	i Introduction/Expectations	2.1 Preparation of a Planning Cost Estimate		
	1 Cost-Estimating Concepts			
9:45				
Break				
9:55	1.1 DOE Cost-Estimating Guidance and Practices	2.1 Preparation of a Planning Cost Estimate (Continued)	2.2 Preparation of a Detailed Cost Estimate (Continued)	3.3 Cost-Estimate Validation Example (Continued)
	1.2 Project Team			
	1.3 Baseline Elements			Closing Remarks Evaluation Form
12:00				
Lunch				
1:00	1.4 Life Cycle of Environmental Restoration Projects	2.1 Preparation of a Planning Cost Estimate (Continued)	3 Validation of a Cost Estimate	Tour of Site - Optional
	1.5 Types of Cost Estimates		3.1 Cost-Estimate Validation	
2:00				
Break				
2:10	1.6 Cost-Estimating Methods and Tools	2.2 Preparation of a Detailed Cost Estimate	3.2 Cost-Estimate Validation Process	
	1.7 Types of Costs			
3:15				End of Workshop
Break				
3:25	1.8 Cost-Estimate Process (Detailed Estimates)	2.2 Preparation of a Detailed Cost Estimate (Continued)	3.2 Cost-Estimate Validation Process (Continued)	
	1.9 Documentation Provided in Cost Estimate			
4:30				

PREFACE

The Practical Cost-Estimating and Validation Lessons-Learned Workshop is sponsored by the Environmental Restoration Applied Cost Engineering (ACE) Team, a joint Field/Headquarters working group. Workshop presentation materials were developed by the Lessons-Learned Workshop Subteam of the ACE Team. These materials were prepared, annotated, and formatted so that any member of the ACE Team or other knowledgeable Field/HQ staff member can be a discussion leader or facilitator for any workshop section. Notebook pages follow a consistent format. Slides are shown at the top of each page. Below the slide, discussion leader/facilitator notes are provided when needed to help guide the discussion, followed by student notes when needed to elaborate on the slide information. At the bottom of each page is a space for notes, lessons learned, and parts that may require further discussion later in the session. ACE Team members may also choose to use these materials to facilitate cost-estimating and validation lessons-learned discussion with their site team.

Feel free to contact any member of the ACE Team for information about this workshop or other activities of the Team. The next few pages include a list of the Lessons-Learned Workshop Subteam members, excerpts from the ACE Team Charter, a list of the ACE Team members, and an acronyms and abbreviations list.

SUBTEAM

Workshop presentation materials were developed by the Practical Cost-Estimating and Validation Lessons-Learned Workshop Subteam of the ACE Team.

Subteam Leader

Autar Rampertaap	HQ, Office of Southwestern Area Programs

Subteam Members

Terry Brennan	Savannah River Site
Al Canepa	National Environment and Technology Institute
Ron Clendenon	Richland Operations Office
Richard Couture	Oakland Operations Office
Rich Fallejo	Oakland Operations Office
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Carol Hathaway	Idaho Operations Office
Rozanne Huntley	Lockheed Martin-Idaho
Sue Jones	Hazardous Waste Remedial Actions Program
Jim Lucas	Lockheed Martin-Idaho
Barbara Schuelke	Rocky Flats Field Office
Anne Sun	Oakland Operations Office
Karen Tenke-White	Chicago Operations Office

ENVIRONMENTAL RESTORATION APPLIED COST ENGINEERING TEAM WORKING GROUP CHARTER

EXCERPTS (from complete charter, issued under B. Skokan memo, December 13, 1996)

Mission

The Applied Cost Engineering (ACE) Team is a joint Field-HQ group encouraging continuous cost-engineering performance improvement for restoration projects across the DOE Complex through promotion of consistent cost-engineering tools, methods, and techniques.

Membership

Membership is open to the representatives of the Operations/Field offices and the Headquarters Office of Environmental Restoration. The Team invites the participation of all interested elements of the Office of Environmental Management (EM) and the Office of Field Management (FM) to reflect the integrated management approach being developed in EM.

Goals/Objectives

- To act as a cooperative resource to provide the tools, lessons learned, and information exchange to enact higher standards of cost control and evaluation throughout the ER complex
- To improve cost estimating for ER projects by:
  - Establishing minimum standards and procedures for centralized collection of scope and cost data and increasing accountability, consistency, credibility, and professionalism;
  - Implementing the Hazardous, Toxic, and Radioactive Waste (HTRW) Work Breakdown Structure;
  - Determining appropriate "tools" such as cost-estimating software; and
  - Collecting scope and cost data for completed DOE ER projects (including decommissioning).
- To facilitate cost reductions at the sites by providing Field project managers the knowledge and tools to evaluate contractor-submitted scope-and-cost estimates and to enable scope-and-cost comparisons for similar projects across the ER complex and other federal agencies.

(Continued on next page)

- To support the overall mission and goals of the Team by accomplishing the following secondary goals:

  - To develop or use an existing data base of cost information based on historic data and recognized, published references;
  - To train ER professionals in the use of both the data base and cost-estimating principles and practices; and
  - To maintain a common vocabulary that may be applied to cost estimating within DOE and other federal agencies for cost comparison.

Need

Control of project costs. ER must use existing resources better by training managers, scientists, and engineers in the basics of performance management in baseline control, cost estimating, and project/program cost reduction and encouraging them to implement this knowledge in their daily activities using a team approach.

Benefits

Successful efforts of the Team will result in the following benefits:

- A common, consistent set of tools to determine the reasonableness of project cost estimates;
- Cost-estimating techniques/software;
- A unit price/cost engineering handbook for ER projects;
- A compilation of historic ER cost estimates for comparison;
- Adoption of an industry standard cost structure that will enable sites to compare accurately costs on similar projects and to identify cost-reduction opportunities;
- Regular Team participation and organized "lessons-learned" workshops whereby field sites will be able to take advantage of the lessons learned at other sites;
- Site-to-site working relationships and a common language and measurement system that will enable sites to implement Departmental and Corporate objectives more efficiently; and
- Reduced costs of doing business.

ACE Team Web Home Page

More information about the ACE Team and its initiatives can be found on the ACE Team's Lesson Learned web home page at http://www.em.doe.gov/aceteam/

APPLIED COST ENGINEERING (ACE) DOE TEAM MEMBERS

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Note: This is a list of the ACE DOE Team Members only. For a detailed list of all members, including other Federal agencies and subcontractors, please see Appendix I.

ACRONYMS AND ABBREVIATIONS

A	A/E	architect/engineer
	AACE	Association for the Advancement of Cost Engineering
	ABC	activity-based costing
	ACE	Applied Cost Engineering Team
	ADS	Activity Data Sheet
	ADP	automated data processing
	AES	automated estimating system
	ALARA	As Low As Reasonably Achievable
B	BA	Budget Authority
	BAFO	best and final offer
	bcf	bank cubic foot
	bcy	bank cubic yard
	BEMR	Baseline Environmental Management Report
	BM	bill of material
	BO	Budget Outlay
C	C/SCSC	cost/schedule control system criteria
	CADD	computer-aided drafting and design
	CAM	Control (Cost) Account Manager
	CAO	Cleanup and Abatement Order
	CC	construction contractor
	CCB	Change Control Board
	CCMAS	Construction Cost Management Analysis System
	CCR	California Code of Regulations
	ccy	compacted cubic yard
	CDR	Conceptual Design Report
	CER	cost-estimating relationship
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	cf	cubic foot
	CFY	current fiscal year
	CFM	cubic feet per minute
	CFR	Code of Federal Regulations
	CM	Construction Management
	CMI	Corrective Measures Implementation
	CMS	Corrective Measures Study
	CPI	Cost Performance Index
	CPM	critical path method
	COA	Code of Accounts
	CORA	Cost of Remedial Action
	CRWQCB	Colorado River Basin Regional Water Quality Control Board
	CSI	Construction Specifications Institute
	cy	cubic yard

D	D/E	design/engineering
	DBP	Drawbar Pull
	DOE	U.S. Department of Energy
E	EAC	estimate at completion
	ECER	enhanced cost-estimating relationship
	ECHOS	Environmental Cost Handling Options and Solutions
	ED&I	engineering, design, and inspection
	EIS	Environmental Impact Statement
	EM	Environmental Management
	EPA	Environmental Protection Agency
	ER	Environmental Restoration
	ETC	estimate to complete
	ES&H	Environmental, Safety, and Health
F	FASA	Federal Acquisition Streamlining Act
	FAST	Freiman Analysis Systems Techniques
	FSAR	Final Safety Analysis Report
	FS	Feasibility Study
	ft	foot
	ft^2	square foot
	FTE	full-time equivalent
	FY	fiscal year
G	G&A	general and administrative
	gal	gallon
	GAO	General Accounting Office
	GFE	government furnished equipment
	gpm	gallons per minute
H	HCAS	Historic Cost-Analysis System
	HQ	Headquarters
	hr	hour
	HTRW	Hazardous, Toxic, and Radioactive Wastes
I	ICE	Independent Cost Estimate
	ICR	Independent Cost Review
	in	inch
	IPABS	Integrated Planning, Accountability, and Budgeting System
	IRB	Internal Review Budget
J		
K		

L	lb	pound
	LCC	life-cycle cost
	LCCE	life-cycle cost estimate
	lcy	loose cubic yard
	lf	linear foot
	LOE	level of effort
M	M&O	Management and Operations
	MCACES	Microcomputer-Aided Cost-Engineering System
	min	minimum
	min	minute
	mph	miles per hour
	MW	megawatt
N	NEPA	National Environmental Policy Act of 1969
	NORM	naturally occurring radioactive material
O	O&M	Operations and Maintenance
	OBS	Organization Breakdown Structure
	ODC	other direct costs
	OMB	Office of Management and Budget
	OPC	other project costs
	OSHA	Occupational Safety and Health Administration
	OU	operable unit
P	P&ID	piping and instrumentation diagram
	PA	Preliminary Assessment
	PACE	Plant and Capital Equipment Fund
	PA/SI	Preliminary Assessment/Site Investigation
	PBS	Project Baseline Summary
	PERT	Program Evaluation Review Techniques
	pH	pH (hydrogen-ion concentration notation)
	PISB	Permanent Isolation Surface Barrier
	PM	Project Management
	PMI	Project Management Institute
	PMP	Project Management Plan
	PPE	personal protective equipment
	PSAR	Preliminary Safety Analysis Report
	psi	pounds per square inch
	PVC	polyvinylchloride
Q	QA	quality assurance
	QC	quality control
	QS	Quantity Survey

R	R&D	research and development
	RA	Remedial Action
	RACER	Remedial Action Cost Engineering and Requirements System
	RAM	Responsibility Assignment Matrix
	RCRA	Resource Conservation and Recovery Act and its amendments, including the Solid Waste Disposal Amendments of 1983 and the Hazardous and Solid Waste Amendments to RCRA
	RD/RA	Remedial Design/Remedial Action
	RFA	RCRA Facility Assessment
	RFI	RCRA Facility Investigation
	RFP	Request for Proposal
	RFQ	Request for Quote
	RI	Remedial Investigation
	RI/FS	Remedial Investigation/Feasibility Studies
	ROD	Record of Decision
S	S&M	Surveillance and Monitoring
	SAR	Safety Analysis Report
	SARA	Superfund Amendments and Reauthorization Act of 1986
	SCBA	self-contained breathing apparatus
	SCEES	Superfund Cost-Estimating Expert System
	sf	square foot
	SI	Site Investigation
	SOW	Statement of Work
	STLC	soluble threshold limit concentration
	SWMU	solid waste management unit
T	TCLP	Toxicity Characteristic Leaching Procedure
	TDS	total dissolved solids
	TEC	total estimated cost
	TPC	total project cost
	TPH	total petroleum hydrocarbons
	TTLC	total threshold limit concentration
U	UM	unit of measure
	UPG	Unit Price Guide
V	VA	value analysis
	VE	value engineering
W	WAG	waste area group
	WBS	work breakdown structure
	wk	week
	WM	Waste Management
X		
Y	yd	yard
	yd^3	square yard
	yr	year
Z		